

EGU23-430, updated on 05 Oct 2023

<https://doi.org/10.5194/egusphere-egu23-430>

EGU General Assembly 2023

© Author(s) 2023. This work is distributed under the Creative Commons Attribution 4.0 License.



Drought influence on flood dynamics: a global overview

Alessia Matano¹, Wouter Berghuijs², Marleen de Ruiter¹, Philip Ward¹, Maurizio Mazzoleni¹, and Anne Van Loon¹

¹Institute for Environmental Studies (IVM), Water and Climate Risk, Vrije Universiteit Amsterdam, Netherlands (alessia.matano@vu.nl)

²Department of Earth Sciences, Earth and Climate Cluster, Vrije Universiteit Amsterdam, Netherlands

Floods and drought affect millions of people each year, but what if a riverine flood rapidly follows or occurs during a hydrological drought?

The 2022 summer drought in Europe, for instance, was punctuated by flash floods, affecting societies, economies and the environment already impacted by the persistent drought. In the same summer, in Iran and Afghanistan, devastating riverine floods followed a severe drought, causing displacement and human losses. Although the abrupt transitions between opposite hydrological extremes can pose huge risks for societies, the processes behind and effects of drought-flood interactions remain largely unknown, as most studies address droughts and floods separately. This research provides the first global study of compound and consecutive drought-flood events, shedding light on the underlying hydrological interactions between opposite hydrological extremes.

By analysing timeseries of hydro-meteorological and other biophysical variables for 8255 catchments globally, we reconstruct the propagation of droughts and floods through the hydrological cycle, thereby identifying and characterizing flood events that follow or compound with drought conditions. We use variable and fixed threshold-level approaches to detect extreme dry and wet conditions, and seasonality statistics to analyse the timing of riverine floods. Our results show that close succession between drought and flood occurs mainly during the transition between seasons: from winter to spring in mid-latitude areas and from dry to wet at the equator and polar regions. Although these events are rare, they have increased over time, especially in countries such as France and Germany, southern Brazil, and India. Furthermore, drought conditions often shift the flood timing, resulting in later winter floods in Europe, in the north-eastern coast of the United States and western Canada, and earlier summer floods in Central America and Northern Brazil.

This study shows that although drought and flood events evolve from different hydrological processes and atmospheric dynamics, these hydrological extremes interact with the same hydrological system, resulting in system alterations that may modify flood dynamics.